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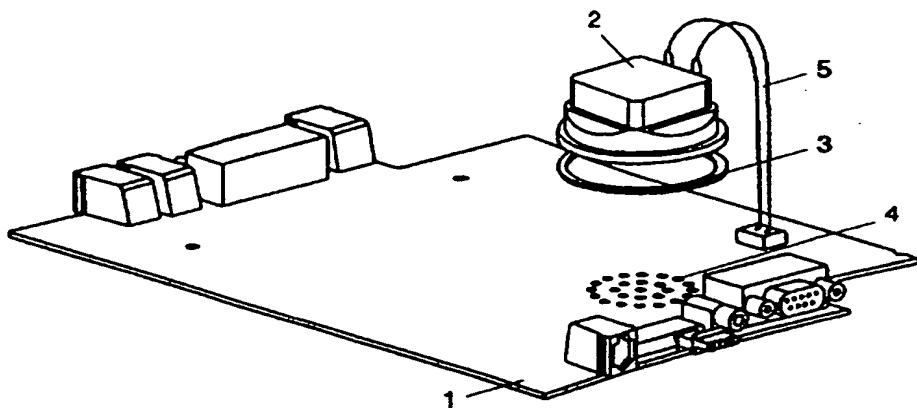
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: <b>PCT/SE96/01376</b></p> <p>(22) International Filing Date: 25 October 1996 (25.10.96)</p> <p>(30) Priority Data: 9503884-0 3 November 1995 (03.11.95) SE</p> <p>(71) Applicant (<i>for all designated States except US</i>): TELEFON- AKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE).</p> <p>(72) Inventors; and</p> <p>(75) Inventors/Applicants (<i>for US only</i>): LINDMAN, Lennart [SE/SE]; Björnmossegången 64, S-135 34 Tyresö (SE). MELLGREN, Ronny [SE/SE]; Amatörvägen 41, S-122 40 Enskede (SE). GUSTAFSSON, Sune [SE/SE]; Boll- morvägen 12 2trp, S-135 40 Tyresö (SE).</p> <p>(74) Agents: BOHLIN, Björn et al.; Telefonaktiebolaget LM Ericsson (publ), Patent and Trademark Dept., S-126 25 Stockholm (SE).</p>		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

## Published

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In English translation (filed in Swedish).*

(54) Title: A METHOD AND DEVICE TO FASTEN A LOUDSPEAKER TO A CIRCUIT BOARD



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## (57) Abstract

With the intention of simplifying the manner in which a loudspeaker is mounted on a circuit board while maintaining requisite sealing and damping between the loudspeaker and the circuit board, the loudspeaker is affixed directly to the circuit board (1) by means of a double-side adhesive annulus (3) with the diaphragm of the loudspeaker facing towards the board, wherein the board has holes (4) located opposite the loudspeaker. The number of holes (4) provided and the size of the holes may be adapted to provide the best sound production in accordance with application. When a loudspeaker is mounted in this way, all components can be collected on the circuit board and therewith simplify manufacture of the telephone apparatus as such, irrespective of whether the circuit board is in the handset or some other part of the apparatus.

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## A METHOD AND DEVICE TO FASTEN A LOUDSPEAKER TO A CIRCUIT BOARD

**FIELD OF INVENTION**

- 5 The present invention relates to a method of mounting at least one loudspeaker, and a loudspeaker mounting arranged in accordance with the method, for instance telephone handsets. Depending partly on their field of use, communications equipment may often include at least one microphone and at least one loudspeaker, which may be fixedly mounted in the equipment.

**DESCRIPTION OF THE BACKGROUND ART**

There are several ways in which a loudspeaker can be fitted 15 to communications equipment. At present, the usual way is to mount the circuit board and loudspeaker separately in a plastic casing with some form of connection therebetween. The loudspeaker is most often suspended softly in a rubber for instance, so as to avoid resonances in a surrounding structure. In those instances when the loudspeakers are mounted 20 on circuit boards, the loudspeakers are always placed with their diaphragms facing away from the board. Loudspeaker mounting processes are required to be simple and inexpensive and the mounting shall fulfill the acoustic requirements 25 placed on the mounting.

DE-A1-3346461 teaches a method of mounting electroacoustic transducers on a conductor plate that has holes opposite the transducers.

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SE-B-451933 teaches a loudspeaker equipped arrangement in which the loudspeaker is mounted in a hole in the circuit board with the diaphragm facing away from the circuit board and with a vibration damping ring placed between the hole and 35 the loudspeaker.

DE-A1-3003714 teaches a telephone apparatus that has an electroacoustic transducer mounted on a circuit board.

#### SUMMARY OF THE INVENTION

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With the intention of simplifying the mounting of a loudspeaker on a circuit board in a telephone apparatus while still obtaining the requisite seal and damping between the loudspeaker and the board so as to achieve good sound production, the loudspeaker has been affixed to the board with double adhesive tape with the diaphragm facing towards the board, which has at least one hole located opposite the loudspeaker. The number of holes provided and the size of said holes can be adapted to provide the best sound production, depending on application. With this type of loudspeaker mounting, all components can be collected on the board, therewith simplifying manufacture of the telephone apparatus as such, irrespective of whether the circuit board is in the handheld (receiver) part of the telephone apparatus or in some other part thereof.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a stage in an inventive loudspeaker mounting process prior to mounting the loudspeaker.

Figure 2 shows an inventive loudspeaker mounting.

#### DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

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Figure 1 is a simplified illustration of a telephone apparatus circuit board 1 that has an integrated loudspeaker circuit. A loudspeaker 2 is shown in a position prior to lowering and affixing the loudspeaker onto the circuit board. Located between the loudspeaker and the circuit board is a flat ring 3 which may be comprised of elastic double-adhesive material, such as elastic double adhesive tape. The

circuit board is perforated with holes 4 in the region beneath the loudspeaker for production of loudspeaker sound. The loudspeaker is connected electrically to the circuit board by twin conductors 5. In the illustrated case, the 5 means by which the necessary seal against the board and the transmission of occurrent mechanical vibrations are damped has the form of an adhesive tape annulus.

Figure 2 shows the loudspeaker firmly mounted on the circuit 10 board with the aid of the adhesive tape annulus, with the loudspeaker diaphragm facing towards the board in the region of the holes 4.

The actual procedure of mounting the loudspeaker on the board 15 is preceded by securing an adhesive annulus 3 to the board 1 after having positioned the annulus in accordance with markings on the board. When the annulus has been fixed in position, the loudspeaker 2 is pressed onto the annulus. It has been found that the bond afforded by a double adhesive 20 annulus, ie an annulus that is adhesive on both sides, is sufficiently strong to resist comprehensive shaking forces, without requiring the assistance of additional fasteners such as screws to this end. Mounting of the loudspeaker is thus a relatively simple process that requires no further connecting 25 means. When the tape used is more or less elastic, it can be used as a soft loudspeaker suspension, therewith obviating the need to use typical rubber packings to this end. The use of hard and non-elastic material is also conceivable, although this use will depend on the application 30 of the invention. When the loudspeaker is mounted in accordance with the invention, the circuit board 1 can be used as a baffle to produce a high sound volume. The holes 4 in the circuit board may also be optimized with respect to prevailing acoustic requirements. The loudspeaker may be mounted 35 on the same side as or on the opposite to other board mounted components, depending on use.

In the case of conference telephones, loudspeaking telephones or a telephone apparatus having a call distribution function, a switching center for instance, the loudspeaker may be placed facing down towards or facing upwardly away from an underlying supportive surface and intended to deliver acoustic signal and also speech signals. For instance, the wiring of a fixed or a mobile telephone apparatus having a circuit board in a combined transceiver unit that includes components and keypad will be greatly simplified when the 10 loudspeaker is mounted directly on the circuit board, said board including sound production holes opposite the loudspeaker diaphragm. Wiring between loudspeaker and remaining circuit components is simplified when the loudspeaker is mounted in the aforesaid manner. The entire electronic unit 15 may consist in one single board when the loudspeaker circuit is integrated in this way.

**CLAIMS**

- 1 A method of mounting at least one loudspeaker in communications equipment, characterized by securing the loudspeaker to the perforated circuit board with the aid of an annulus comprised of double-sided adhesive material, such as double-sided adhesive tape, located between the loudspeaker and the circuit board, with the diaphragm of the loudspeaker facing towards circuit board.
- 10 2. A loudspeaker mounting means for mounting at least one loudspeaker in communications equipment, characterized in that the loudspeaker (2) is intended to be affixed to circuit board perforated with holes (4) with the aid of an annulus (3) comprised of double-sided adhesive material, such as double-sided adhesive tape, located between the loudspeaker and the circuit board, with the diaphragm of the loudspeaker facing towards circuit board.
- 15 3. A mounting means according to Claim 2, characterized in that the adhesive material (3) is soft and elastic.
- 20 4. A mounting means according to Claim 2, characterized in that the adhesive material (3) is hard and non-elastic.

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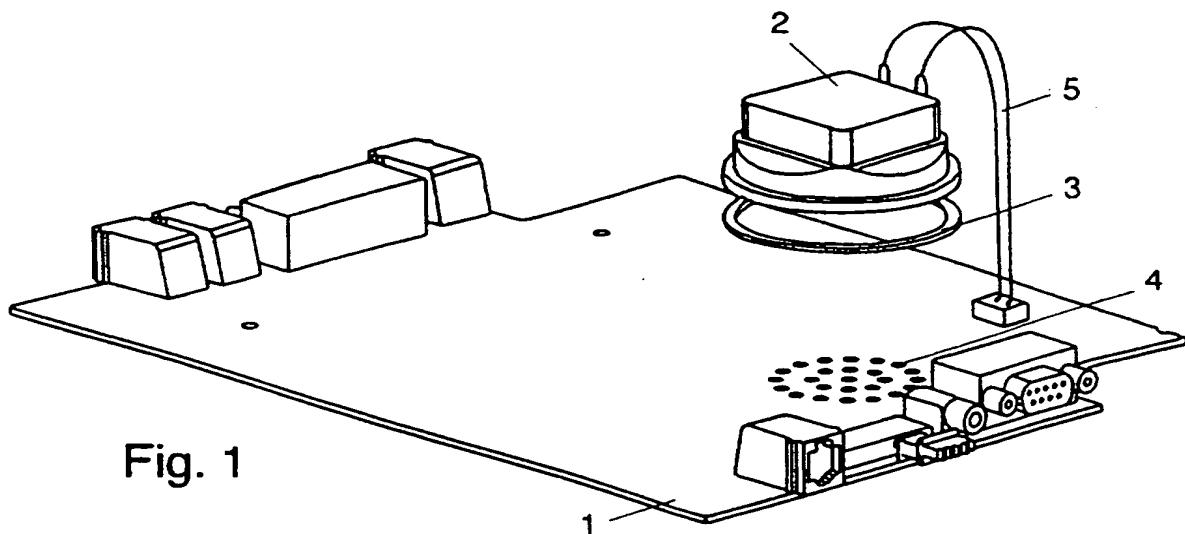


Fig. 1

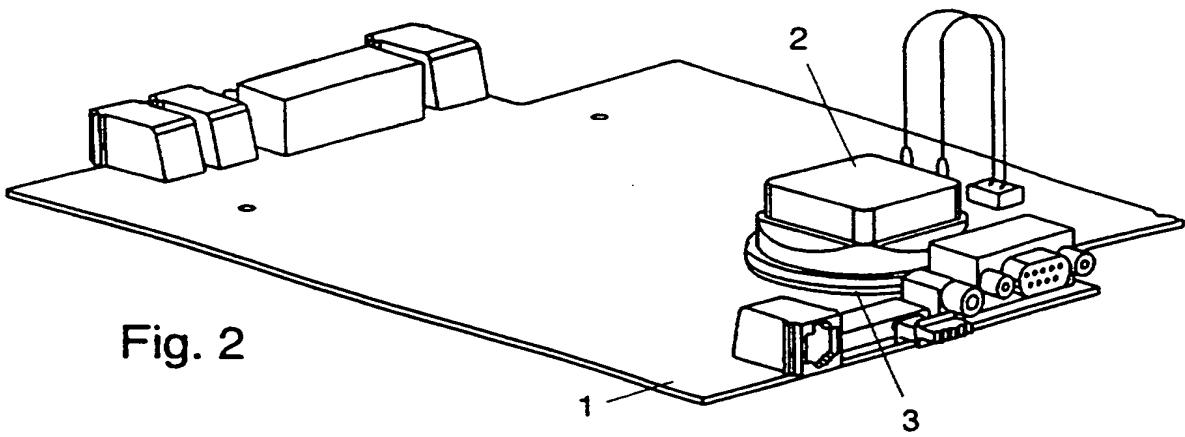


Fig. 2

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 96/01376

## A. CLASSIFICATION OF SUBJECT MATTER

**IPC6: H04M 1/02**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC6: H04M, H04R**

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 8503613 A1 (GNT AUTOMATIC A/S), 15 August 1985 (15.08.85), page 14, line 20 - page 16, line 3, figures 1-11, abstract --	1-4
Y	DE 3346461 A1 (SIEMENS AG), 4 July 1985 (04.07.85), page 5, column 34 - page 6, line 1, figures 1-3, abstract --	1-4
Y	EP 0218832 A1 (SIEMENS AKTIENGESELLSCHAFT BERLIN UND MÜNCHEN), 22 April 1987 (22.04.87), figures 1-3, claim 6, abstract --	1-4

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10 January 1997	03 -02- 1997
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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	SE 451933 A (ELLEMTEL UTVECKLINGS AB), 2 November 1987 (02.11.87), page 3, line 6 - line 9, figures 1-3, abstract  --	1-4
A	EP 0203680 A2 (MARCONI ELECTRONIC DEVICES LIMITED), 3 December 1986 (03.12.86), page 6, line 25 - line 27, figures 1-2, abstract  -- -----	1-4

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

28/10/96

International application No.

PCT/SE 96/01376

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO-A1- 8503613	15/08/85	AU-A-	3938285	27/08/85
		EP-A-	0173701	12/03/86
		JP-T-	61501362	03/07/86
DE-A1- 3346461	04/07/85	NONE		
EP-A1- 0218832	22/04/87	JP-A-	62081719	15/04/87
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